NOBLE GAS COMPONENT "Q" IN HF/HCL-RESISTANT RESIDUES OF UNEQUILIBRATED CHONDRITES. H. Busemann, H. Baur, and R. Wieler, ETH Zürich, Isotope Geology, NO C61, CH-8092 Zürich, Switzerland. E-mail: busemann@erdw.ethz.ch

Noble gases in two HF/HCL-resistant residues of the CO3.4 chondrite Lancé and the H3.7 chondrite Dimmitt have been measured by closed-system stepped etching (CSSE) in order to determine the trapped noble gases, especially the light gases He and Ne, sited in "phase Q". The elemental compositions resemble the abundances in meteorites of other classes deduced earlier [1-3]. However, the isotopic compositions show considerable deviations. In particular, the ^{20}Ne/^{22}Ne ratio for Lancé (10.10 ± 0.14) differs from values known for Allende and Murchison (10.7 ± 0.2) [1, 2], but is similar to that infered for Ne-Q in the H-chondrite Dhajala (10.11 ± 0.16) [3].

Continuing our closed-system stepped etching (CSSE) experiments [1, 2] to determine the trapped noble gas component that resides in the ill-defined carbonaceous "phase Q"**,** we prepared several HF/HCL-resistant residues. The goal of these studies is to further test the presumption of one global uniform component trapped during the accretion of parent bodies of unequilibrated chondrites of different classes.

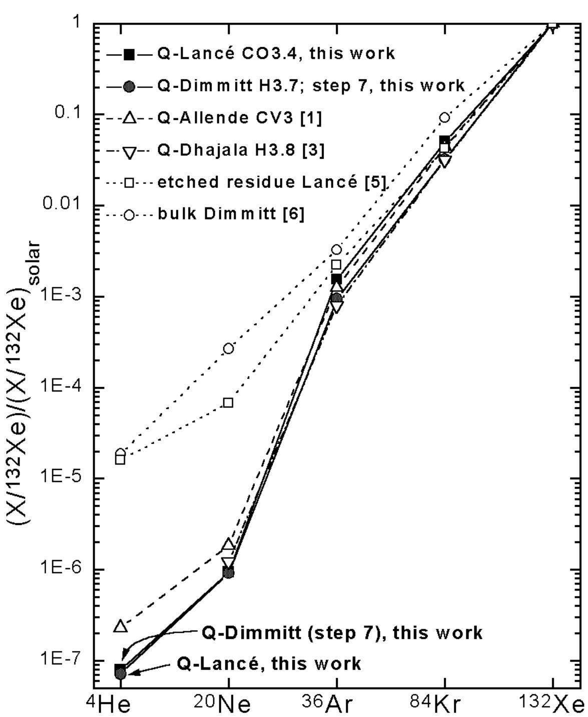

Fig. 1: The elemental composition of Q [1, 3, this work] (normalized to ^{132}Xe) relative to the solar abundances [4]. For comparison, data of an oxidized etched residue from Lancé [5] (with a dominating "exotic" component) and the bulk data of Dimmitt [6] are also shown. The similar He and Ne abundances in the various Q samples is striking.

So far, we measured the meteorites Lancé (CO3) [7] and Dimmitt (H3.7). The latter analysis is still in progress. HF/HCL dissolution cycles yielded residues amounting to 1.01 % and 1.82 % of the bulk meteorite masses, respectively. On-line-etching was carried out first by vapour and in later steps by liquid $HN0_3$ (65 %) at temperatures of up to 90°C. At least 7 steps could be performed in each case. 67.15 mg (Lancé) and 470.08 mg (Dimmitt) of the residues, respectively, were loaded in the gold-platinum on-line etch device [1, 2].

Since Dimmitt is a solar-gas-rich regolith breccia, it offered the possibility to test the ability of the CSSE technique to separate component Q from other "contaminating" noble gases. With the CO chondrite Lancé, we complemented our series of investigations on carbonaceous chondrites [1, 2].

Earlier measurements [1-3] estabished a well-defined elemental composition of Q noble gases (Fig. 1). The light gases were strongly depleted relative to the solar abundances [4] (seven orders of magnitude in the case of He). He and Ne suffered an even stronger fractionation than what would be expected by extrapolating the trend of the heavier noble gases. Fig. 1 shows the new data as solid symbols (the sum of all steps for Lancé, one typical Ne-Q dominated step for Dimmitt, see below). The figure also displays the elemental abundances of Q in the carbonaceous chondrite Allende and in the H-chondrite Dhajala [1, 3], as well as abundances in samples where He and Ne are dominated by "exotic" components in presolar micro-diamonds [5, 6]. The abundances of He and Ne in the various Q samples differ by no more than a factor of 3 (He), in contrast to the depletion in He-Q of seven orders of magnitude relative to the solar He abundance. This agreement is a strong argument for the assumption of one global noble gas reservoir incorporated in the parent bodies of several classes of meteorites, because subsequent parent body processes would hardly lead to such consistent values.

The most interesting isotope ratio is ^{20}Ne/^{22}Ne (Fig. 2). Various studies of different meteorite types [1-3, 5, 8] with different techniques produced values for Ne-Q ranging from 10.1 to 10.7. The single etch steps of Lancé lie on a mixing-line including the bulk value [9]. Extrapolation of this line (assuming ^{21}Ne/^{22}Ne = 0.029) leads to a ^{20}Ne/^{22}Ne ratio of 10.10 ± 0.14 for Q-Lancé. This value is lower than those of Q-Allende and Q-Murchison [1, 2] but lies close to the value for Dhajala (^{20}Ne/^{22}Ne = 10.11 ± 0.16 [3]).

The data pattern for Dimmitt (Fig. 2) shows that part of the solar gases survived the HF/HCL treatment, since the first three steps released trapped Ne between the solar wind ($^{20}Ne/^{22}Ne = 13.8$ [10]) and the SEP composition [10]. However, the last two or three steps measured so far are consistent with the assumption that the remaining trapped Ne is almost or completely pure Ne-Q. We deduce a preliminary $^{20}Ne/^{22}Ne$ ratio for Q-Dimmitt between 10.4 and 10.8.

Lancé, Dhajala (and possibly also Dimmitt) have somewhat lower $^{20}Ne/^{22}Ne$ ratios in the Q-component than Allende and Murchison, and the former three samples also have lower Ne/Xe ratios than the latter. Qualitatively, the limited data are thus consistent with the hypothesis that the Ne-Q composition in the various meteorites has been modified by parent-body metamorphism [11], although the isotopic fractionation is somewhat larger than may be expected for diffusion. It seems unlikely that the low $^{20}Ne/^{22}Ne$ value in Q-Lancé is caused by contamination of a "pure" Ne-Q component as represented by Allende or Murchison [1, 2] with Ne-A [12] or atmospheric Ne. Such mixing would have to be quite constant in a large number of release fractions, and there is also no hint

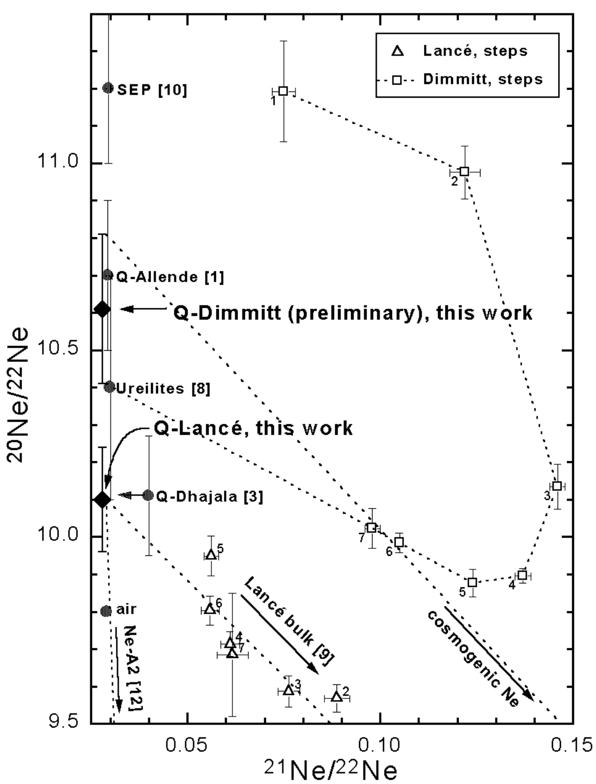

Fig. 2: Three-isotope-plot of neon with different Q-like data points. Included are the last steps of the Lancé experiment and all data points of Dimmitt existing at the time of the abstract deadline. The data pattern for Dimmitt clearly shows the progressive enrichment of Ne-Q relative to trapped solar Ne released predominantly in the first steps. The preliminary Ne-Q composition has been derived from the last two steps.

for an additional Xe-HL contamination (which is coupled to Ne-A) in the Lancé steps. The measured $^{40}Ar/^{36}Ar$ ratios (between 1 and 20) also clearly rule out appreciable Ne atmospheric contamination.

In Lancé, the component Q for the heavier noble gases ($^{36}Ar/^{38}Ar$, Kr, and Xe) quite well agrees with the data published for Q-Allende and Q-Murchison [1, 2], and also with the component "P1" ($\equiv$Q) determined by Huss et al. [11] in several unequilibrated chondrites. However, preliminary results from the Dimmitt experiment hint towards a somewhat higher $^{36}Ar/^{38}Ar$ ratio which presumably cannot be explained by contamination with solar Ar. Unexpectedly, the $^{3}He/^{4}He$ data for both, Lancé and Dimmitt, are several times higher than the He-Q value of 0.000159 determined for Allende [1] and also higher than that of potentially contaminating solar He. It may be that cosmogenic He compromises these data, although no correlation with cosmogenic Ne is apparent.

In summary, with these new, directly obtained data for the noble gas component Q in a CO and an unequilibrated H chondrite, we determined elemental compositions very similar to those measured earlier in CV and CM chondrites. The isotopic composition of Ne-Q is somewhat variable, in a way qualitatively consistent with diffusive losses, presumedly in the parent-body.

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